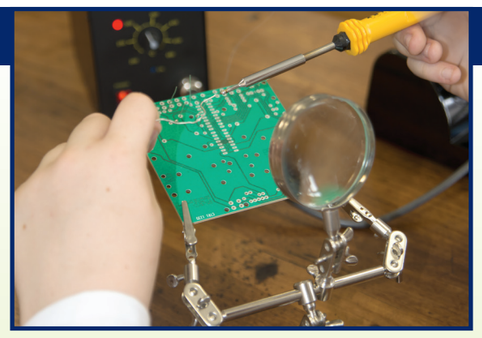
AN INTRODUCTION TO SOLDERING



1. WHAT IS SOLDERING?

Soldering is the joining together of two metals to give physical bonding and good electrical conductivity. Solder is a combination of metals, which are solid at normal room temperatures and become liquid at between 180 and 230°C. Solder bonds well to various metals, and extremely well to copper.

Soldering has many uses. It is used primarily to assemble electronic components such as resistors, capacitors and IC's onto printed circuit boards. However, it can also be used to join wires, metals, and even manufacture jewellery.

In electronics **LEADFREE** fluxed core **SOLDER** is used. This consists of approximately 99% Tin and 1% copper depending on the brand of solder used. Sometimes a small percentage of silver is added to soften the solder and reduce the melting point temperature.

FLUX is an aggressive chemical that removes oxides and impurities from the parts to be soldered. This ensures a good physical and electrical joint is made. Fluxes enable good 'wetting' or 'tinning'. Wetting is a term that describes good adhesion of the solder to the components being soldered. Tinning is a term that describes the application of solder to the soldering iron tip, or to a component being prepared for soldering.

2. SOLDERING IRON

These are the tools which heat the solder from room temperature to its melting point. A modern basic electrical soldering iron consists of the following:

The **HEATING ELEMENT** can be either a resistance wire wound around a ceramic tube, or a thick film resistance element printed onto a ceramic base. The element is then insulated and placed into a metal tube for strength and protection. This is then thermally insulated from the handle. The element reaches temperatures of around 370 to 400°C.

The **SOLDERING BIT** is a specially shaped piece of copper plated with iron and then usually plated with chrome. Copper is used for good thermal conductivity. Iron is very resistant to aggressive solders and fluxes. The bit then fits over or inside the heating element dependant on the design of the soldering iron.

The **HANDLE AND POWER CORD** completes the soldering iron. Various handle styles are available. The power cord is often insulated with PVC. But, this can be damaged and melt if touched by a hot soldering iron. Therefore silicone rubber insulated power leads are extremely popular for long life and electrical safety.

3. IRON SELECTION

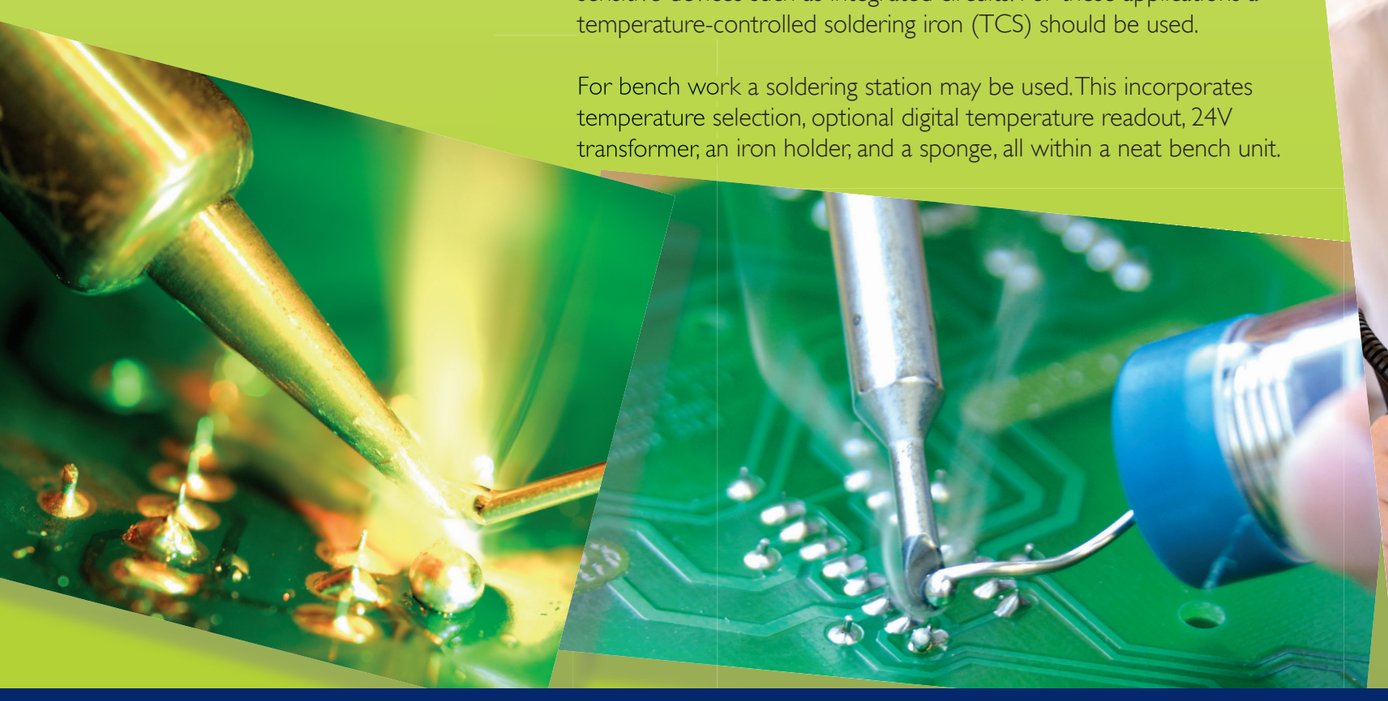
The strength or power of a soldering iron is usually expressed in Watts. Irons generally used in electronics are typically in the range 12 to 25 Watts. The most popular irons for use in schools or for hobbyist electronics are the 18 and 25-Watt versions.

It must be remembered that a 25-Watt iron will not run hotter than a 12-Watt iron, but it will have more power available to quickly replace heat drained from the iron during soldering. Therefore, the bigger the component being soldered, the greater the need for "quantity of heat", the higher the power needed.

Most irons are available in a variety of voltages, 12V, 24V, 115V, and 230V are the most popular. You should always use a low voltage iron where possible, as it is much safer.

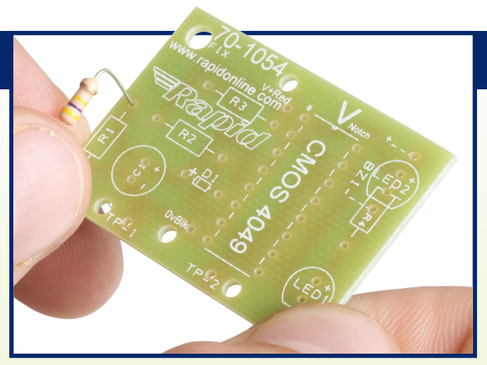
As your soldering skills improve, you may work with temperature sensitive devices such as integrated circuits. For these applications a temperature-controlled soldering iron (TCS) should be used.

For bench work a soldering station may be used. This incorporates temperature selection, optional digital temperature readout, 24V transformer, an iron holder, and a sponge, all within a neat bench unit.



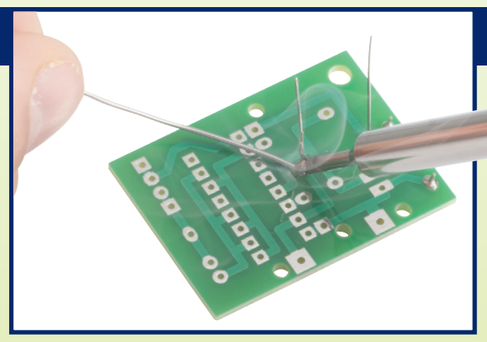
4. PREPARATION

1. If using multi-stranded wire such as 7/0.2 equipment wire, twist the strands together and tin the end of the wire.
2. Bend the lead to fit the position on the PCB. Do not bend too close to the component body as damage to the component may occur.
3. If the component is temperature sensitive use a pair of pliers as a heatsink between the component body and the point to be soldered.
4. Tin the site where the component is to be soldered.



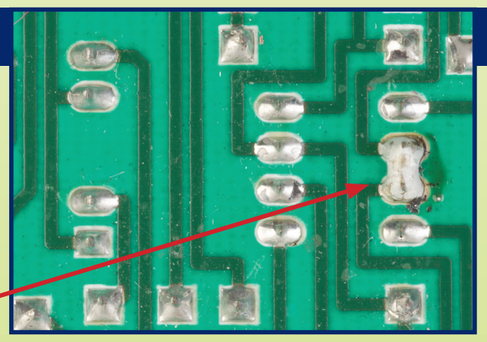
5. SOLDERING

1. Switch on the soldering iron and feed solder to the tip of the iron as it heats up.
2. Wipe off excess solder onto a damp sponge
3. Place the hot iron on the component lead and the PCB pad. Feed the solder into the far side of the component lead . Solder will begin to flow around the lead. Do not use too much solder.
4. Next remove the solder source followed by the iron.
5. Do not disturb the component for a few seconds until the solder has solidified.
6. Trim the component leads to within 1mm of the soldered joint.



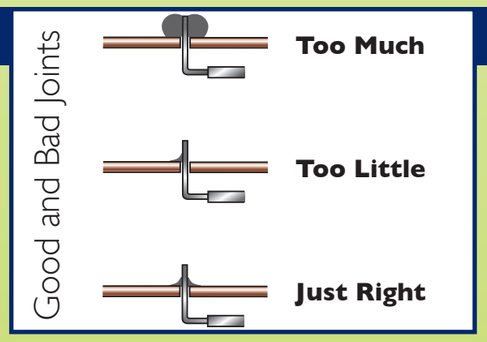
6. TAKE CARE

1. Plan the component layout.
2. Mount the smallest components first.
3. Try to leave component identification markings visible
4. Support heat-producing components above the PCB with ceramic beads.
5. Keep soldering time to a minimum to reduce the risk of heat damage to the component.
6. Beware of solder bridging across tracks. This could cause a short circuit.
7. If working with static sensitive components always use a wrist strap connected to an earthing point.



7. CHECK YOUR WORK

1. Are all of the components in place?
2. Are all of the soldered joints neat and tidy?
3. Is there too much or too little solder on the joint?
4. Has the solder flowed evenly around the lead?
5. Is the solder joint nice and shiny?
6. Are all components inserted the right way around? (Check polarity!)
7. Check for solder bridges.



8. ADDITIONAL INFORMATION

In common with all tools, a soldering iron will last longer with correct care and maintenance.

1. Always wipe the bit on a damp sponge prior to making a soldered joint. Most bench stands incorporate a sponge for this purpose.
2. Always apply solder to the bit of an iron as it heats up. This will ensure good tinning and long life of the bit.
3. A solder bit that will not wet can be cleaned by lightly rubbing the bit with a nylon pad. Ensure the iron is switched off and do not use wire wool or emery paper as this will remove protective plating and shorten the bit life.
4. Always keep a hot iron in a bench stand.
5. Never put a soldering iron into liquid.
6. Regularly check the cable for burns. Alternatively use an iron that is supplied with silicone cable which is resistant to burns from the soldering iron.

It is sometimes necessary to remove a component from a PCB. To desolder a component melt the solder around the component with a soldering iron. When the solder flows remove the molten solder with a desolder pump. Replace the iron in a stand and allow the component to cool for a few seconds. Carefully remove the component from the holes in the PCB.

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